

REMARKS

The present application had claims 1-5, 9-12 and 15-19 pending. Applicants have herein above cancelled claim 2 and amended claims 1, 4, 15 and 19. Claim 1 was amended to incorporate the limitation of dependent claim 2, which was then cancelled. Claims 4, 15 and 19 were amended in minor ways to clarify their language. Support for the amendment of claim 4 may be found on page 4, line 28 of the specification. No new matter has been introduced by the amendments. Claims 1, 3-5, 9-12 and 15-19 are now pending.

In the August 23, 2007 Office Action, the Examiner rejects the claimed subject matter as obvious to one of ordinary skill in the art in view of Fischer, Goller and Campbell. Applicants disagree.

An object of the present invention is to provide an ink for producing catalyst and electrode layers with improved adhesion, better electrical performance and improved screen life (see, for instance, specification, page 4, lines 11-14). The inventors of the present invention discovered that an ink containing substantially water as a solvent has surprisingly good adhesion to the polymer membrane, among other properties, when the ink contains preferably 5 to 25 wt. % of a solvent from a group of linear dialcohols (see page 5, line 19-23).

This finding is supported by comparison example 1 and the examples 1, 2 and 3 of the specification. For the fully water-based ink of comparison example (CE1), the adhesion of the catalyst layers to the membrane proved to be inadequate -- peeling of the layers occurred (see, page 8, line 8-10). In contrast, the membrane adhesion of the electrode layers made with inks according to examples 1, 2 and 3 was very good (see page 9, line 4-5; page 9, line 19-20 and page 10, line 6-7).

The discovery that the adhesion quality of electrode/catalyst layers may be improved by means of controlling the ratio of linear dialcohol solvent vs. the total water content of the ink is novel and surprising, and certainly not obvious from the cited Fischer, Goller or Campbell references.

The references cited by the Examiner fail to disclose or teach a water-based ink composition that contains an aqueous solution of an ionomer, and a solvent which is substantially water with 5 to 25 wt. % of a co-solvent from a group of linear dialcohols with a flash point higher than 100 °C, as required by amended claim 1. Moreover, none of the cited references, either alone or in combination, suggest that adhesion of the electrode/catalyst layers made from water-based inks may be improved by the use of a solvent which is substantially water with 5 to 25 wt. % of a co-solvent from the group of specified linear dialcohols.

Fischer discloses inks with a total water content of 27.5% (see Fischer specification, page 3, line 2-3) and a glycerine content of 37.2% (see page 3, line 2). Thus, the organic solvent is the major solvent component of the Fischer inks, unlike that of the present invention where water is the major solvent component. Accordingly, (as admitted by the Examiner is the August 23rd Office Action) Fischer fails to teach a water-based ink having an aqueous solution of ionomer and a solvent that is substantially water, as required by the pending claims.

Even if, for the sake of argument, the glycerine of Fischer is considered to be equivalent to the required linear dialcohols of the present invention (which is not the case), Fischer does not teach that specific water to organic solvent ratios improve adhesion of electrode/catalyst layers made from the ink.

Goller describes inking vehicles for a suspension of carbon particles and fluorocarbon polymer particles (see claim 1 of Goller, for example). The Goller vehicles are based on "ethylene glycol/glycerine and (...) some other possible inking vehicles are pure glycerine, pure glycol or other dibasic or tribasic alcohols" (Goller, column 5, lines 13-18). Goller is silent to the use of water as an ink solvent and to specific water to organic solvent ratios in the ink.

Campbell discloses carbon supported catalysts for fuel cells with sufficient acidic surface groups. The teaching of Campbell is not directed to catalyst inks. Campbell refers to the fact that carbon-supported catalysts are applied in the form of an ionomer ink, which comprises an ionomer solution. Campbell does not disclose specific compositions or weight ratios. In particular, Campbell is silent to the use of organic solvents and specific water to organic solvent ratios. Accordingly, Campbell fails to teach or suggest the ink compositions presently claimed. Furthermore, Campbell does not teach that specific water to organic solvent ratios improve adhesion of electrode/catalyst layers made from the ink.

In light of the fact that each of the cited references fail to disclose or teach the ink composition of the presently pending claims and fail to teach or suggest that specific water to organic solvent ratios improve adhesion of electrode/catalyst layers made from the ink, Applicants maintain that the present obviousness rejections are improper. There is no teaching, suggestion or motivation for combining the cited references as done so by the Examiner. And, even if combine, one does not achieve the ink compositions of the present claims; namely, a water-based ink having an aqueous solution of ionomer and a solvent that is substantially water with 5 to 25 wt. % of a co-solvent from the group of specified linear dialcohols.

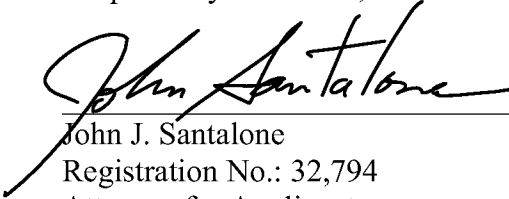
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In view of the above arguments and amendments, Applicants respectfully request that the rejections set forth in the August 23rd Office Action be withdrawn and that the application be deemed in condition for allowance.

No additional fee is believed to be due with respect to the filing of this reply, other than the fee for a three month extension of time. If any fee is due, please charge our Deposit Account No. 11-0171 for such sum.

If the Examiner has any questions regarding the present application, the Examiner is cordially invited to contact Applicants' attorney at the telephone number provided below.

Respectfully submitted,


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